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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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CANDIDATE NAME

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4565210539

BIOLOGY **9700/31**

Paper 31 Advanced Practical Skills **October/November 2007**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the confidential instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
You are advised to spend an hour on each question.
At the end of the examination, fasten all your work securely together.

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1	
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You are reminded that you have only one hour for each question in the practical examination.
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1 The enzyme catalase is found in a wide range of living organisms. It catalyses the breakdown of hydrogen peroxide which is a highly reactive by-product of respiration.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

The rate of this reaction can be monitored by measuring the rate of bubble production of oxygen gas.

You are required to investigate the effect of potato tissue extract on hydrogen peroxide.

Take care. Hydrogen peroxide is corrosive when in contact with skin or eyes. Wear safety glasses while performing this experiment.

You are provided with 40 cm^3 of water, labelled **beaker 1**.
You are provided with 20 cm^3 of 20 vol H_2O_2, labelled **beaker 2**.
You are also provided with 10 cm^3 of potato tissue extract containing catalase, labelled **C**.

You are going to make a serial dilution of the 20 vol H_2O_2.

- Label two small beakers **3** and **4**.
- Into beaker **3** place 10 cm^3 of 20 vol H_2O_2 from **beaker 2**.
- Add an equal volume of water from **beaker 1** to produce 10 vol H_2O_2.

- Into beaker 4 place 10 cm^3 of 10 vol H_2O_2 from **beaker 3**.
- Add an equal volume of water from **beaker 1** to produce 5 vol H_2O_2.

You are provided with the apparatus as shown in Fig. 1.1.

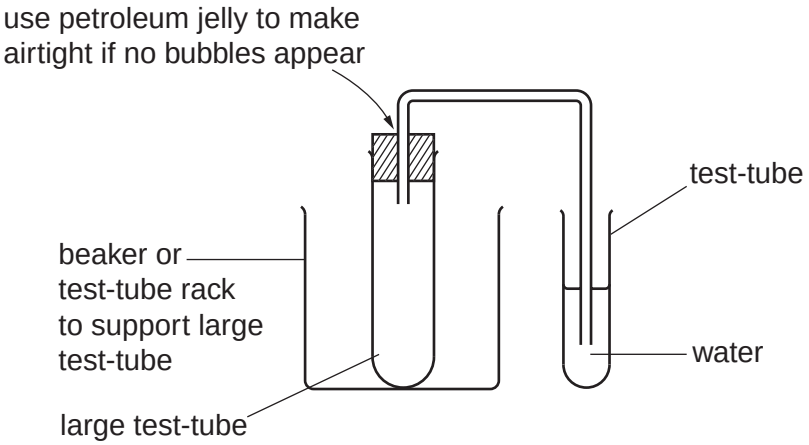


Fig. 1.1

- Place 4 cm^3 of 20 vol H_2O_2 from **beaker 2** into the large test-tube. Add 1 cm^3 of potato extract solution **C**. **Immediately** place the bung of the delivery tube firmly into the large test-tube. Bubbles of gas should come from the end of the delivery tube.
- If no bubbles appear then use petroleum jelly to make the delivery tube airtight.

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(a) Determine the number of bubbles produced in an appropriate length of time.

Repeat the process with solutions from beakers **1**, **3** and **4**.

(i) Record your results in the space below.

[2]

(ii) Identify the most significant source of error in the collection of your data.

.....

.....[1]

(iii) Describe how you could modify your experiment to make the results more reliable.

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.....[3]

(b) A student carried out a similar experiment. The student used a constant concentration of hydrogen peroxide but used **pieces** of potato tissue of varying surface area.

(i) Describe how you would prepare the potato pieces.

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.....

.....

.....[3]

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Table 1.1 shows the data the student recorded.

Table 1.1

volume of potato tissue / cm^3	surface area of potato tissue / cm^2	time taken to produce 40 cm^3 of gas / secs
1	1	180
1	2	110
1	4	62
1	8	27

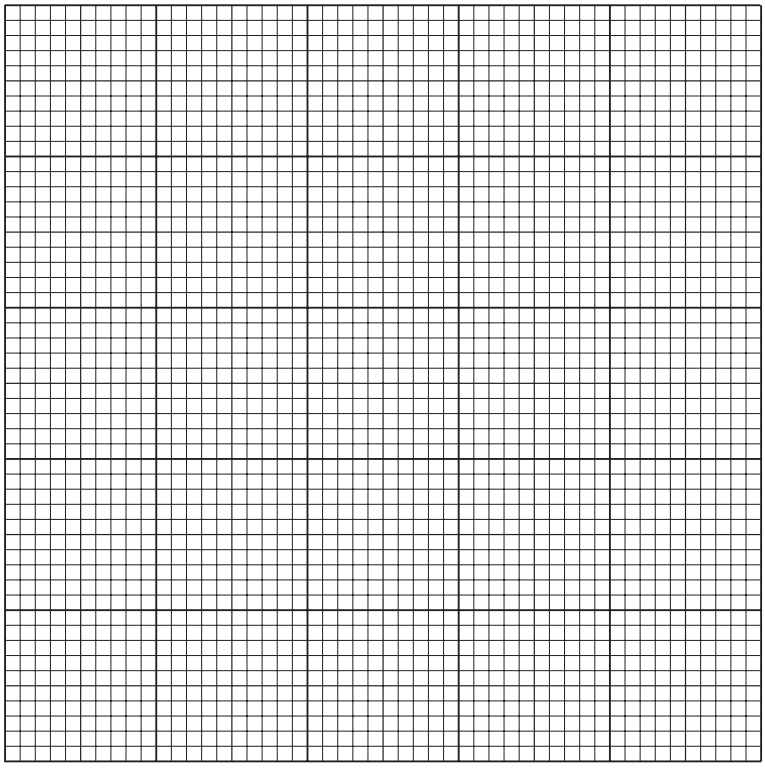
(ii) Suggest a control for this experiment.
Give a reason for this control.

.....

.....

.....[2]

(iii) Plot a graph of the student's data on the grid below to show the effect of surface area on gas production.



[4]

(iv) Describe the pattern shown by the results.

.....

.....[1]

(v) Using your knowledge of enzymes and the information provided, explain the pattern shown by the results.

.....

.....

.....[2]

(vi) Use your graph to determine the time taken for a piece of potato of 5.5 cm^2 to evolve 40 cm^3 of gas.

.....[2]

(vii) Calculate the rate of reaction in cm^3 of gas per second for a piece of potato of 5.5 cm^2.

.....[1]

(c) Describe how you would set up and perform a similar experiment to determine the effect of temperature on the rate of the reaction.

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.....[4]

[Total: 25]

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2 **(a)** You are provided with a stage micrometer scale on a microscope slide.
The 1 cm stage scale is divided into 100 divisions.
The length of each division is 0.1 mm.

Calculate the length of each division **in micrometres**.
Show your working.

.....μm [1]

(b) **(i)** Your microscope has been fitted with an eyepiece graticule. **J1** is a transverse section of a stem. Carefully examine the section under the high-power of your microscope. Put a ring around the number written on the objective lens.

× 40 4 mm $\frac{1}{6}$ other .....

Identify a large, empty xylem vessel and adjust the slide so that the xylem vessel is in the centre of your field of vision.

Count the number of divisions of the eyepiece graticule across the diameter of the xylem vessel.

number of divisions .....

(ii) Remove the slide and replace it with the stage micrometer scale.
Using the same magnification, adjust the focus until you can see the eyepiece graticule on top of the stage scale.

Explain why the stage scale appears larger than the eyepiece graticule.

.....

.....

.....[1]

(iii) Count the number of eyepiece graticule divisions that fit into one stage scale division.

number of eyepiece graticule divisions .....

Use this information to calculate the actual width between each division on the eyepiece graticule.
Show your working.

.....[2]

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(iv) Calculate the actual diameter of the xylem vessel.

.....[2]

(c) Make a large, low-power, labelled plan diagram of **one quarter** the section, **J1**.

[5]

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[Turn over

(d) Make a large, high-power, labelled drawing to show the cells present in a vascular bundle including a phloem sieve tube and the cells immediately next to it. No more than eight cells should be drawn.

[4]

[Total: 15]

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CANDIDATE NAME

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1757404495

BIOLOGY **9700/32**

Paper 3 Practical Test AS **October/November 2007**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the confidential instructions

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1 You are provided with four strips of potato, labelled **P,** and a solution, labelled **S**.
You are also provided with the following materials.
- Benedict's solution
- distilled water

(a) Use the Benedict's solution to identify the nature of the unknown solution **S**.

Cut **one** of the potato strips into several pieces. Repeat the test on the pieces of the potato strip.

Describe the tests performed and their meaning.

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.....

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.....

.....

.....[2]

(b) You are now going to investigate the effect of solution **S** on potato strips **P**.
Carefully follow the instructions below. Take care to organise your equipment so that your results are recorded correctly.
You should present and record your observations and data in the space provided.
You will need to:
- read through the instructions carefully,
- make some decisions,
- prepare the space on page **3** so that it is ready for you to record the readings.
- Place 20 cm^3 of solution **S** in a Petri dish.
- Place 10 cm^3 of solution **S** and 10 cm^3 of distilled water in a second Petri dish.
- Place 20 cm^3 of distilled water in a third Petri dish.
- Using a scalpel or sharp knife, carefully trim as accurately as possible, each potato strip to a length of 50 mm.
- Place one potato strip into each of the three Petri dishes.
- Tilt the Petri dish as shown in Fig. 1.1 so that the strips are covered by the solution.



Fig. 1.1

- Leave for at least 30 minutes.

While you are waiting you should move on to Questions 1(d) to (f).

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- After 30 minutes, remove the strips from the Petri dishes and blot them carefully with a paper towel. Accurately measure their lengths and record any observations of differences between them.

(i) Record the data and observations in the space below.

[4]

(ii) Estimate the uncertainty in the measurement of the actual length of the potato strip that has been in water.

actual size measured .....

uncertainty = ...[1]

(iii) Suggest how an error in measuring the lengths could occur.

.....

.....

.....[1]

(c) Temperature is a variable that was not controlled in this experiment.

(i) Suggest how temperature could be controlled.

.....

.....[1]

(ii) Identify two **other** significant sources of error in this experiment other than temperature.

1. .....

.....

2. .....

.....[2]

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[Turn over

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(d) In a similar investigation involving a range of sucrose concentrations, the results in Table 1.1 were obtained.

Table 1.1

sucrose solution concentration / mol dm^{-3}	percentage change in length of strips
0.00 water	+5.0
0.2	+2.5
0.4	–1.0
0.6	–1.5
0.8	–6.3
1.0	

(i) At 1.0 mol dm^{-3} sucrose concentration, the mean length of strips before the experiment was 80.0 mm and after the experiment was 73.0 mm.

Calculate the missing value for the percentage change in length of the strips and complete Table 1.1.
You may use the space below to show your working.

[1]

(ii) When the student first performed this experiment the percentage change in length in a 0.8 mol dm^{-3} solution was +3 %. Suggest what the student did when this result was obtained and explain why.

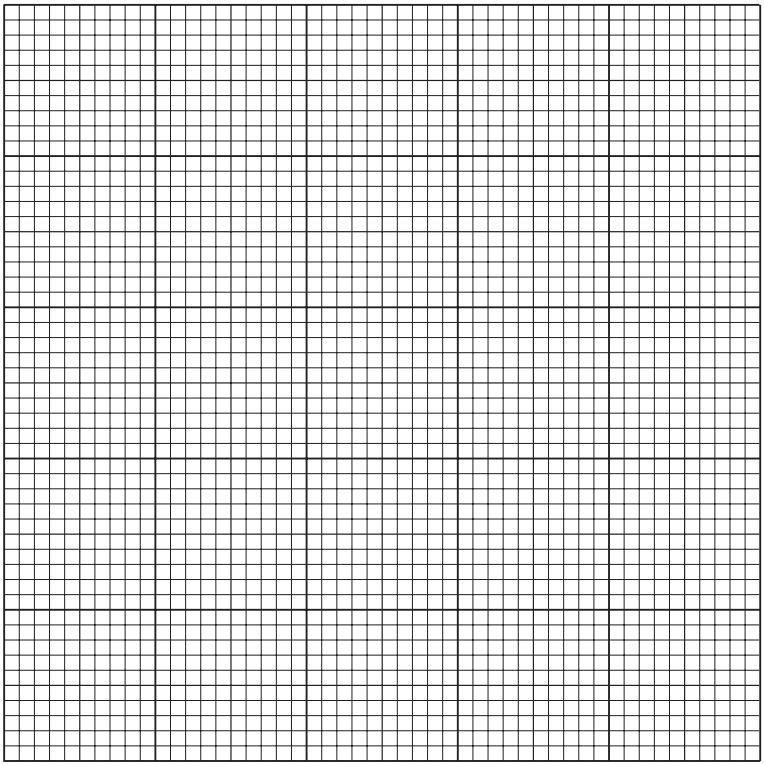
.....

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.....[1]

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(iii) Plot a graph of the percentage change in length of the strips against the concentration of the sucrose solution using the student's results.



[3]

(e) The concentration of sucrose solution that would give no change in length was not found very precisely in the experiment. Suggest how it could be improved to give this more precisely.

.....

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.....

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.....[3]

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(f) The student's hypothesis was

- the more concentrated the solution, the smaller the potato strips became.

Draw an appropriate conclusion to the student's experiment.
You should include in your conclusion whether the experimental data support the hypothesis and produce a revised or new conclusion if necessary.

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.....[3]

(g) Other then temperature, suggest how the student could improve the experiment to reduce errors.

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.....

.....[3]

[Total: 25]

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2 You are provided with slide **K1**.

(a) (i) Draw a low-power plan diagram of the specimen on slide **K1**.

[2]

(ii) Use a ruler to measure the actual size of the specimen on slide **K1** and the size of your drawing across the same point.
Draw a line on your drawing to show where you made your measurement.
Calculate the magnification of your drawing.
Show your working.

magnification .....[2]

(b) The cartilage tissue on slide **K1** has been stained purple.

(i) In the space below, make a high-power, labelled drawing of two adjacent cells in this tissue.

[6]

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Fig. 2.1 is a photomicrograph of a transverse section of an aorta.

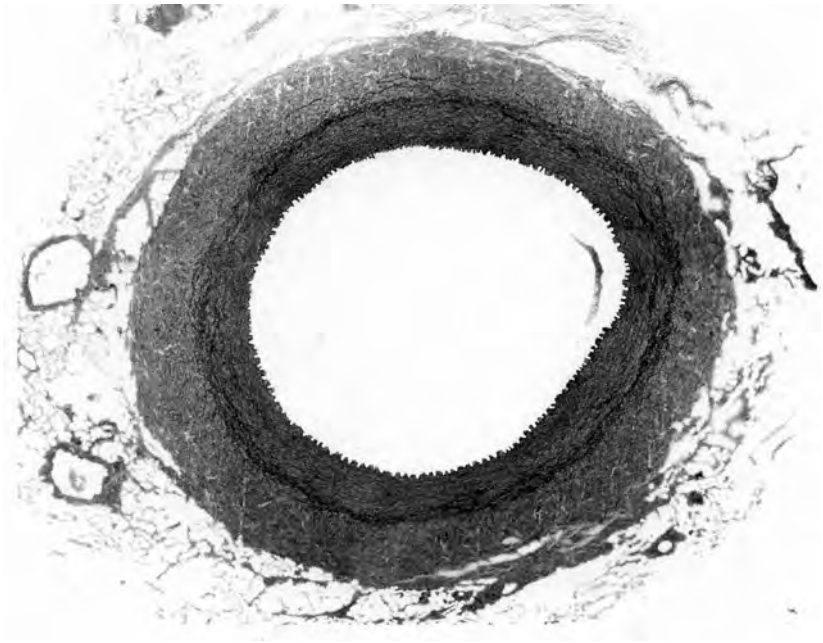


Fig. 2.1

(ii) Prepare the space below so that it is suitable for you to compare and contrast specimen **K1** with **Fig. 2.1** and then record your observations.

[4]

(iii) Both the specimens, **K1** and Fig. **2.1**, are involved in the movement of materials. State one observation that relates to this function.

.....

.....[1]

[Total: 15]

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